LIMNOLOGY

Project title: **Ecosystem-Level Impacts of the New Zealand Mudsnail to the Firehole River: A Preliminary Study**

Principal investigator: Dr. Robert Hall
Phone number: 307-766-2877
Email: *bhall@uwyo.edu*
Address: Dept. of Zoology and Physiology
University of Wyoming
Laramie, WY 82070

Objective: The objectives of this research are to: 1) develop methods to estimate growth rates and secondary production of *Potamopyrgus*; and 2) to collect necessary preliminary data so that a larger study of the impact of the mudsnail on nutrient transfer through stream food webs may be undertaken. Pretreatment data to be collected are biomass of snail and native invertebrates at one time so that I can estimate potential effect of snail in material cycling within the food web.

Findings: I found that I could paint and recapture snails to estimate growth rate, but this only worked for large sanils that are not growing quickly. Concomitant studies by Dr. Mark Dybdahl show that enclosing snails in small (10 cm) chambers for several weeks is sufficient to measure growth rates. I am still counting and sorting snails and invertebrates to estimate biomass in the Firehole River. Samples for museum collection accession #1815 are being identified and stored in my laboratory until completion of the project.

Project title: **The Biogeochemistry of Sublacustrine Geothermal Vents in Yellowstone Lake**

Principal investigator: Dr. Val Klump
Phone number: 414-382-1700
Email: *vklump@uwm.edu*
Address: Great Lakes WATER Institute
University of Wisconsin-Milwaukee
600 E. Greenfield Ave
Milwaukee, WI 53204

Additional investigators: Russell Cuhel, James Maki, Tony Remsen, Carmen Aguilar

Objective: Yellowstone Lake is an ecosystem in which closely linked components of microbiology, geochemistry, and mineral reactivity justify the term "Biogeochemical Cycling". The overall objective is to develop quantitative understanding leading to a biogeochemical flux and mass balance model for hydrothermal vent systems. More specific objectives are as follows: 1) To determine the importance of vent and fumarole emanations relative to shallow groundwater and sediment-water flux in enrichment of major ions of Yellowstone Lake water. 2) To identify short (hours-days) and long-term (annual) variability in submarine vent activity. 3) To assess the potential geochemical interactions with iron during formation of iron oxides formed via vent fluid interactions with cold lake water. 4) To determine the relative importance of abiotic sulfur oxidation and microbially-mediated sulfur oxidation. 5) To determine the specific contributions of photosynthetic, heterotrophic and chemolithotrophic biomass production. 6) To analyze transformations of sulfur by measuring the stable isotope composition of mineral, organic matter, and micro- and macro- organisms. 7) To utilize trace metal concentrations in aqueous and solid phases to evaluate hydrothermal activity and geochemical processes participating in elemental cycling. 8) To estimate the quantitative impact of sublacustrine hydrothermal vents and springs on the biogeochemical mass balance for the lake.

These efforts are intended to lead to a significant quantitative improvement in understanding of biogeochemical dynamics for select parameters. Control of nutrient and trace element cycling involves physical transport (e.g., riverine inflow and outflow, sediment-water flux, hydrothermal venting, groundwater inflow and outflow, mixing), chemical transformation (e.g., sorption by minerals precipitated from vent fluids, precipitation and dissolution, oxidation-reduction transformations), and biological interactions (e.g., assimilation into biomass, energy-yielding oxidation-reduction transformations, organic matter diagnosis). This work will provide background necessary to begin modeling basin-wide fluxes of biogeochemical important elements to elucidate the contribution of geothermally altered groundwater to Yellowstone Lake.

Findings: In the summer of 1999, approximately 14 days of ROV exploration and field operations were successfully completed. New vents and vent fields were discovered in West Thumb at sites previously described by Kaplinski as potential hydrothermal spring areas, based upon his observations and bathymetric charting. The relict hydrothermal features discovered several years ago in Bridge Bay, the so-called "spires", were revisited. These vertical columns, up to 20 feet or more in height, appear to be old hydrothermal "chimneys" reminiscent of similar hydrothermal deposits seen on the mid ocean ridge spreading centers. With the help of the NPS dive team, the Lake Ranger Station, and the NPS research office, a piece of one of these spires (ca. 60 cm x 25 cm, 14 kg), which had apparently broken off at some earlier time, was recovered and brought to the surface. We are currently analyzing this fragment at the Great Lakes WATER Institute of the University of Wisconsin-Milwaukee to determine its potential origin and age. Studies on the interaction between vent hydrochemistry and microbial activity continued. Strong evidence for mineral-dependent bacterial productivity was obtained, a unique feature of Yellowstone Lake. Chemosynthetic production rates are similar to photosynthetic rates on a per liter basis. Studies of near vent plume-mixing and chemical reactions rates also continued with promising results suggesting the utility of Radon-222 as a tracer and reaction rate monitor. Recording thermistors were deployed at a number of sites to obtain a long term (~1 year) record of thermal activity. Additional work on dating of sediments and pore water chemistry was also undertaken. Some of these results will appear in the proceedings of the "Symposium on the Greater Yellowstone GEO-Ecosystem."

Prior to our 1999 field work, we cooperated with the USGS supported- and conducted- multi-beam high precision bathymetric survey of the northern fifth of the lake. The complex topography observed correlated well with our previous in situ studies, and revealed some potentially spectacular and heretofore unseen features on the lake bottom as well. We hope to pursue ground-truthing of these features in the future (2000-01).